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(54) **Geared motor**

(57) A geared motor, in particular for adjustable motor-vehicle seats, comprises an electric motor (1) and worm gearing (3) combined with the electric motor (1) to form a unit. The worm (19) of the worm gearing is mounted in a gear casing (11) on a main shaft (7) of the electric motor and the main shaft extends into the gear casing and is mounted thereon. The worm wheel (25) of the gearing is securely fitted on a driven shaft (27) likewise mounted in the gear casing. The driven shaft is mounted in the gear casing on axially opposite sides of the worm wheel, the worm wheel being seated both axially fixed and incapable of independent rotation thereon, and being retained axially by two casing surfaces holding the worm wheel between them.

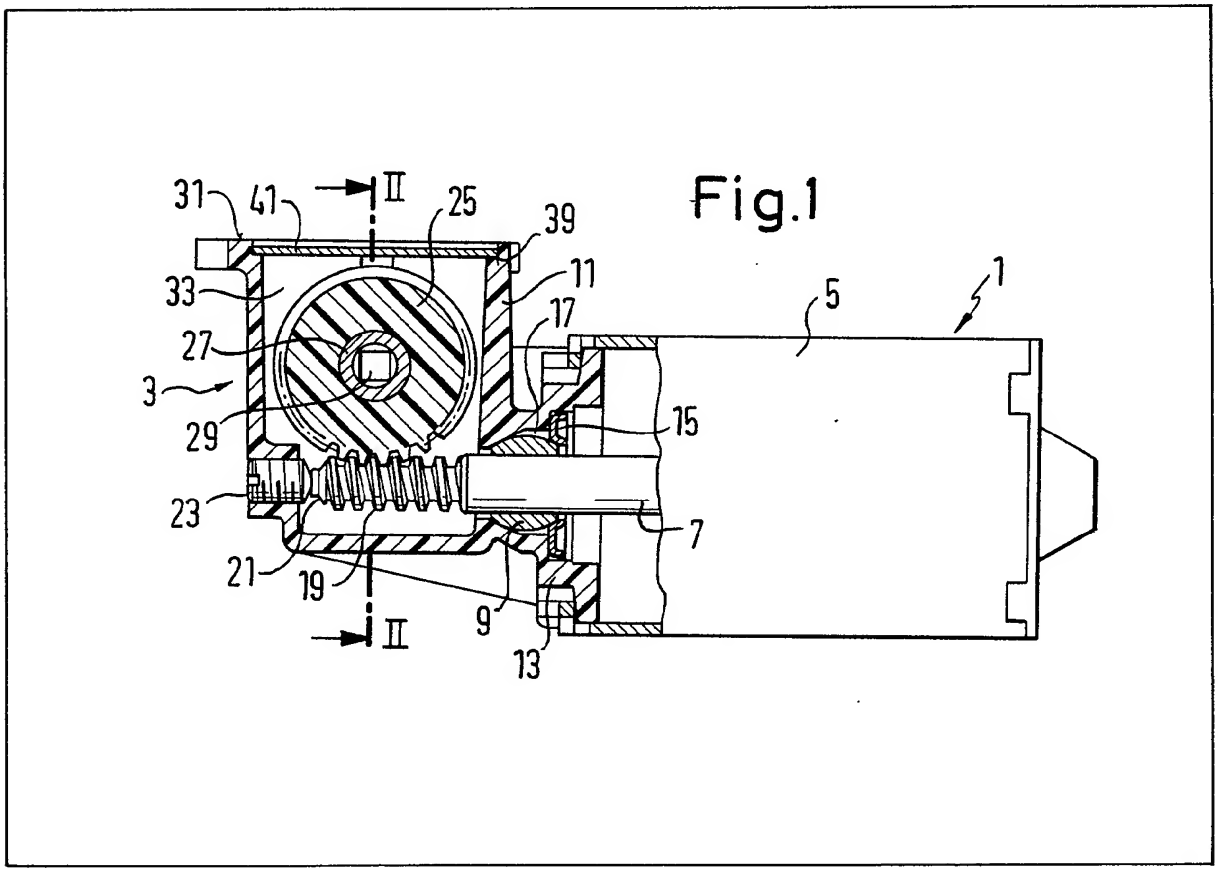


Fig.1

GB 2 040 389 A

Fig.1

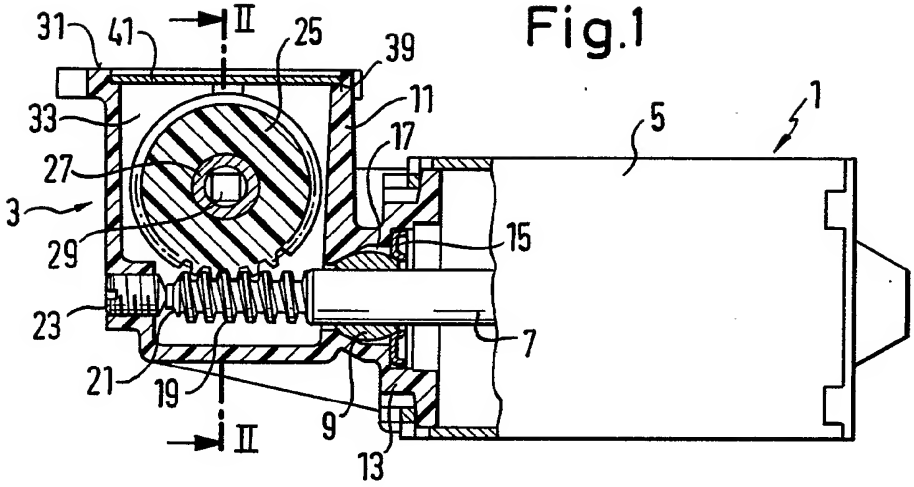


Fig.2

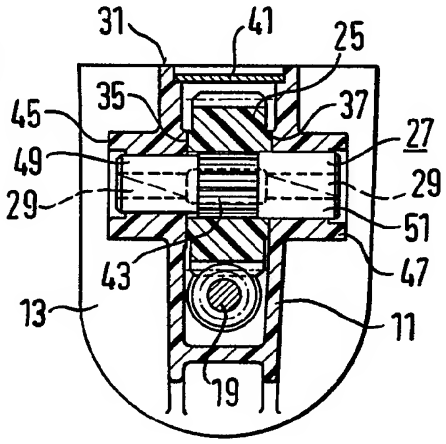


Fig.3

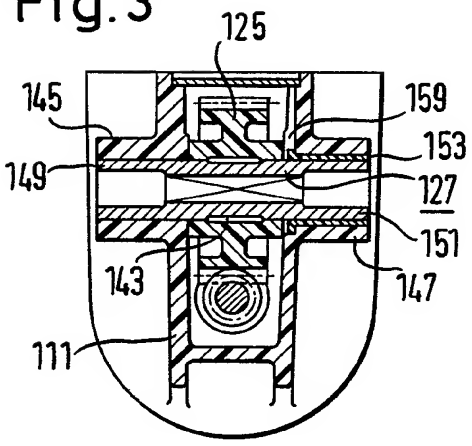


Fig.4

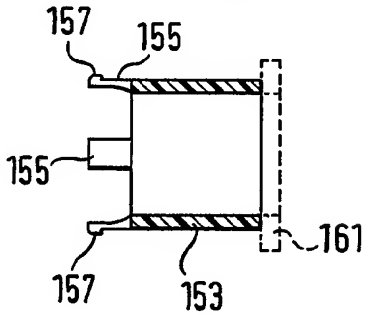


Fig.5

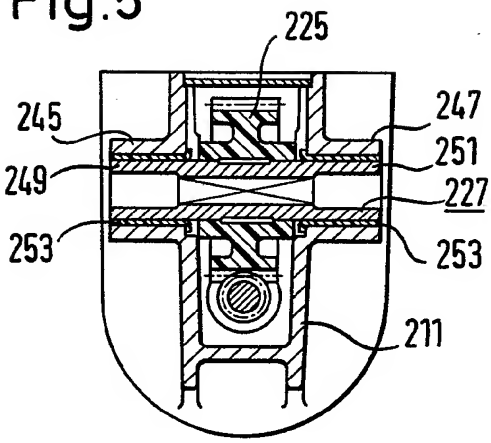


Fig.6

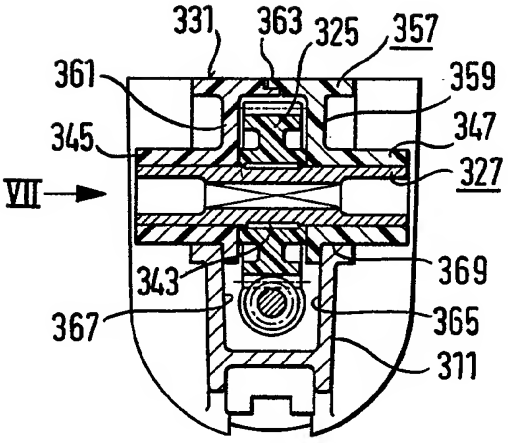
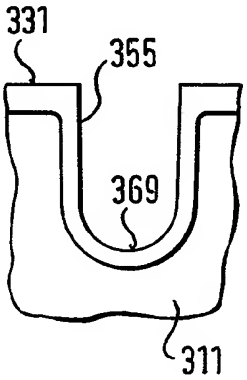


Fig.7



SPECIFICATION

Geared motor

The invention relates to a geared motor, more particularly but not exclusively for adjustable motor-vehicle seats, having an electric motor and a worm gearing combined with the electric motor to form a unit, the worm of said gearing being mounted in a gear casing so as to be capable of independent rotation on a main shaft of the electric motor, this mian shaft extending into the gear casing and being mounted therein, and the worm wheel of said gearing being securely fitted on a driven shaft likewise mounted in the gear casing.

A geared motor of this type is known from the German Offenlegungsschrift 2 646 886 as a drive for a windscreen wiper of a motor vehicle. The worm wheel of this geared motor is fitted so as to be incapable of independent rotation at one end of the driven shaft which is rotatably mounted in a bearing flange of the gear casing and emerges from that side of the bearing flange remote from the worm wheel. A retaining ring secures the driven shaft axially. The worm mates with the end face of the worm wheel nearest the driven shaft, so that the retaining ring securing the driven shaft axially has to take up the axial bearing pressure. The driven shaft is guided in a bearing bush screwed into the bearing flange, which bush has to withstand not only the lateral load through the driven shaft but also the axial load through the retaining ring.

In order to be able to combine the worm gearing with the electric motor it is necessary for the worm to be arranged on the main shaft, after the motor has been flange-mounted on the gear casing. Accordingly, the assembly of the geared motor is relatively complicated. Moreover, it is necessary for the worm and main shaft to be of special and thus relatively expensive design, so as to enable assembly to be carried out.

According to the invention there is provided a geared motor comprising an electric motor and a worm gearing combined with the electric motor to form a unit, the worm of said gearing being mounted in a gear casing on a main shaft of the electric motor which main shaft extends into the gear casing and is mounted thereon, and the worm wheel of said gearing being securely fitted on a driven shaft likewise mounted in the gear casing, the driven shaft being mounted in the gear casing on axially opposite sides of the worm wheel, said worm wheel being seated both axially fixed and incapable of independent rotation thereon, and being retained axially by two casing surfaces holding the worm wheel between them.

In this case the worm mates with the periphery of the worm wheel and loads the driven shaft symmetrically.

Axial forces are taken up by the casing surfaces passing by the worm wheel on either side.

Considerable importance is attached to preferred embodiments which are characterised in that the part of the gear casing holding the electric motor and the driven shaft is a one-piece moulded part, in that in the region of the worm wheel the driven shaft carries a peripheral fluting or peripheral toothing which projects radially beyond the diameter of at least one of the two shaft portions extending as far as the associated axial end or ends, in that at least one of the two shaft portions is seated in an exteriorly open plain-bearing aperture whose internal diameter is equal to or larger than the external diameter of the peripheral fluting or peripheral toothing. This embodiment is distinguished by relatively simple installation. Before or after the electric motor with the worm seated on its main shaft is mounted on the gear casing and the worm wheel is installed in the gear casing, it is possible for the driven shaft, despite the protruding peripheral fluting or peripheral toothing, to be inserted through the plain-bearing aperture and pressed into the worm wheel.

To keep the production costs of the driven shaft as low as possible, peripheral flutes are preferably impressed into a portion of the driven shaft by means of a knurling tool, which portion is equal in diameter to at least one of the two shaft portions. To ensure that the two shaft portions fit with as little play as possible into the associated bearing apertures, either the driven shaft can be of different diameter of either side of the peripheral fluting, or a space-compensating bush can be inserted into the open plain-bearing aperture. The use of a space-compensating bush has the advantage that the driven shaft has the same diameter on either side of the peripheral fluting and thus can be produced from a simple rod section of uniform cross-section.

The space-compensating bush is pushed into the plain-bearing aperture after the pressing-in of the driven shaft. For fastening it is possible to provide on the space-compensating bush at least one snap member engaging in the gear casing, which snap member secures the space-compensating bush axially and/or peripherally. It has been found suitable to use book-like radially flexible tongues which project axially from one end of the space-compensating bush, which can be inserted through the annular clearance between the plain-bearing aperture and driven shaft, and which engage with their hooks behind the rim of the plain-bearing aperture on the worm-wheel side. However, the spacing bush may also have on its outwardly facing axial end a radially outward projecting flange and may be adhered to the gear casing.

In preferred embodiment, the space-compensating bush consists of plastics. If no space-compensating bushes are required for mounting the driven shaft of the worm wheel, the gear casing consists of plastics at least in the region of the bearing aperture for the driven shaft. Preferably, the gear casing is designed as a one-piece injection-moulded plastics part.

Preferably, on that side of the gear casing remote from the worm there is provided an insertion aperture for the worm wheel, which aperture can be closed by a cover and is directed towards the fastening surface of the geared motor. The cover may be of structurally simple design, since after installation of the geared motor it is positioned between the gear casing and the mounting surface, i.e. it is no longer

accessible and is not subjected to any mechanical stress.

Another preferred embodiment of the geared motor is characterised in that in a part of the gear casing holding the electric motor there is provided a poket, open transversely to the axial direction of the worm, for a worm-wheel holder which can be inserted into the pocket, and in that for the installation if the worm wheel in the worm-wheel holder the worm-wheel holder is divided transversely to the driven shaft. In this embodiment the driven shaft is connected to the worm wheel before the installation of the worm wheel, or may be already formed integrally therewith. The two parts of the worm-wheel holder are mounted on the shaft portions projecting on either side of the worm wheel and after insertion into the pocket of the gear casing are held together by the pocket. The pocket is preferably open towards the fastening surface of the geared motor and the worm-wheel holder terminates at the fastening surface, so that when the geared motor is installed it cannot drop out of the pocket. The worm-wheel holder does of course have to be secured during conveyance, before its installation in the pocket.

In order to be able to press the two parts of the worm-wheel holder together, in the direction of the driven shaft the pocket preferably has mutually facing stop faces between which the divided worm-wheel holder is inserted.

For coupling the driven shaft to the adjustment members of the driven component, in particular the adjustment members of the motor-vehicle seat, the driven shaft preferably has at least one of its axial end faces an axial orifice with polygonal internal profile. The space requirement of the driven shaft in its axial direction is thus small. In particular, the axial orifice may lie within the walls of the gear casing, so that even when transmitting relatively high torques the inner profile can be damaged only with difficulty due to enlargement of the driven shaft. If the driven shaft consists of plastics, the inner profile may be reinforced by a metal reinforcement.

The invention further provides an adjustable vehicle seat comprising a geared motor according to the invention.

By way of example four embodiments of a geared motor according to the invention will now be described with reference to the accompanying drawingsin which:—

Figure 1 shows a part longitudinal section through a first embodiment of a geared motor.

Figure 2 shows a cross-section along the line II-II in Figure 1;

Figure 3 shows a sectional view similar to Figure 2 through a second embodiment of the geared motor;

Figure 4 shows an axial section through a spacing bush of the geared motor according to Figure 3;

Figure 5 shows a sectional view similar to Figure 2 through a third embodiment of a geared motor;

Figure 6 shows a sectional view similar to Figure 2 through a fourth embodiment of a geared motor; and

Figure 7 shows a side view of a detail of a gear casing of the geared motor according to Figure 6, viewed in the direction of the arrow VII.

Figures 1 and 2 show a geared motor for driving an electrically adjustable motor-vehicle seat. The geared motor comprises an electric motor 1 which is combined with a worm gearing 3 to form a unit. The electric motor 1 has a main shaft 7 which projects on one side from its housing 5 and which is rotatably mounted by means of a spherical bearing 9 in a gear casing 11 of the worm gearing, said gear casing being formed as a moulded plastics part. The spherical bearing 9 is mounted in a flange 13 of the gear casing 11, which flange simultaneously forms the driven-side end plate of the electric motor 1. A sealing ring 15 retains the sphere of the spherical bearing 9 in a recess 17 of the flange 13 widening towards the motor housing 5.

The main shaft 7 at its free end penetrating into the gear casing 11 a worm 19 and is supported at its front end 21 against an axially adjustable axial thrust bearing 23. The worm 19 mates with the peripheral toothing of a worm wheel 25 which is mounted both so as to be incapable of independent rotation and axially fixed on a driven shaft 27 extending transversely to the axis of the main shaft 7. The driven shaft 27 has at both ends axially accessible square internal holes 29 for coupling with a corresponding square section of the drive shaft of the motor-vehicle seat. The worm wheel 25 is situated in a chamber 33, which is open towards the fastening surface 31 of the geared motor 1, between two mutually facing stop surfaces 35, 37 which axially secure the worm wheel 25 and the driven shaft 27 connected to the worm wheel 25. A simple non-supporting cover 41 inserted in a channel 39 of the casing aperture closes the chamber 33. The cover 41 needs to be secured essentially only for conveyance, since it is held in the channel 39 by the mounting surface of the motor-vehicle seat upon attaching the geared motor by means of fastening means (not shown in any detail).

The driven shaft 27 carries a peripheral knurling 43 and is mounted on either side of the peripheral knurling 43 respectively in exteriorly open bearing shoulders 45 and 47 of the gear casing 11. The shaft portions 49, 51 on either side of the peripheral knurling 43 are of different diameter. The diameter of the shaft portion 51 is equal to or slightly larger than the outer diameter of the peripheral knurling 43. The peripheral knurling 43 is in turn formed on a shaft portion with the same diameter as the shaft portion 49. The shaft portions 49, 51 have smooth surfaces and run directly in the bearing shoulders 45 and 47 formed integrally with the plastics gear casing 11.

The geared motor may be assembled very simply. Before or after the fitting of the gear casing 11 to the motor housing 5, the worm wheel 25 is inserted into the chamber 33 and the driven shaft 27 with the smaller diameter shaft portion 49 to the front is pressed through the bearing shoulder 47 of larger diameter into the worm wheel 25 made of plastics. The chamber 33 is subsequently closed with the cover 41.

Figures 3 and 4 show a second embodiment of a geared motor particularly suitable for driving adjustable motor-vehicle seats, which embodiment substantially differs from the geared motor in Figure 1

and 2 only in the design and mounting of the worm wheel 125 and associated driven shaft 127. In the description of the second embodiment, reference numerals are used which are increased by a number of 100 in relation to the reference numerals of parts having the same function in the embodiment according to Figures 1 and 2. Therefore, for a clearer understanding reference is made to the description of Figures 1 and 2.

The driven shaft 127 is again provided axially in the centre with a peripheral knurling 143. In contrast to the embodiment of Figures 1 and 2, however, the shaft portions 149, 151 disposed on either side of the peripheral knurling 143 are of equal diameter. Accordingly, it is possible for the driven shaft 127 to be produced from a rod section with constant external diameter. The shaft portion 149 is mounted directly in a bearing shoulder 145 formed integrally with the gear casing 111. Both the bearing shoulder 145 and the gear casing 111 consist of plastics. The shaft portion 151 is mounted in a bearing shoulder 147 of the gear casing 111, whose internal diameter is equal to or slightly larger than the external diameter of the peripheral knurling 143. A plastics space-compensating bush 153 is inserted in the bearing shoulder 147, which bush compensates for the difference in diameter between shaft portion 151 and bearing shoulder 147. The space-compensating bush 153 has axially nearest the worm wheel 125, which tongues taper towards their free end and at the free end have lugs 157 projecting radially outwards beyond the outer bush circumference. After the driven shaft 127 has been pressed into the plastics worm wheel 125 it is possible for the space-compensating bush 153 to be inserted from outside into the bearing shoulder 147. In this case the lugs 157 provided at the tapered end of the tongues 155 are forced resiliently radially inwards and in the end position they snap into recesses 159 on the axially inward end face of the bearing shoulder 147. In this way the space-compensating bush 153 is secured so as to be incapable of independent rotation and also fixed axially.

In Figure 4 a dashed line indicates an annular flange 161 which projects radially outwards from the axially exterior side end of the space-compensating bush 153. The annular flange 161 may be provided in addition to or instead of the tongues 155 and determines the axial penetration depth of the space-compensating bush 153. If no tongues 155 are provided, it is possible for the space-compensating bush 153 to be adhered to the bearing shoulder 147 along its outer periphery or along the annular flange 161.

Figure 5 shows an embodiment of a geared motor, which differs from the embodiment of Figures 3 and 4 merely in that space-compensating bushed 253 are inserted in both bearing shoulders 245, 247 formed integrally with the gear casing 211, which space-compensating bushes compensate for the difference in diameter between the internal diameter of the bearing apertures of the bearing shoulders 245, 247 and the external diameter of the associated shaft portions 249, 251 of the driven shaft 227. The reference numerals of the embodiment according to Figure 5 differ from the reference numerals of parts having the same function in the embodiment of Figure 3 and 4 by a number "2" placed in front thereof. For a better understanding reference is thus made to the description of this embodiment. Since both shaft portions 249, 251 are mounted in space-compensating bushes 253 preferably consisting of plastics, it is possible for the gear casing 211 to be made of a different material, for example of diecast metal. The space-compensating bushes 253 are in the form shown in Figure 4 and are likewise inserted from outside after the pressing-in of the driven shaft 227 into the plastics worm wheel 225. Like the space-compensating bush 153, it is possible for the space-compensating bushes 253 to consist of a plastics material chosen to have the most suitable anti-friction properties. However, the plastics material of the gear casing 111 or 211 can be reinforced with fibrous material, for example glass fibres.

The embodiment of a geared motor illustrated on the basis of Figures 6 and 7 differs from the embodiment of Figure 1 essentially in the design of the worm gearing. Parts having the same function are designated with reference numerals increased by a number of 300 with respect to Figure 1. For a better understanding reference is made to the description of Figure 1.

Figure 6 also illustrates a gear casing 311 carrying the electric motor, which has a pocket 355 open towards the fastening surface 331 of the geared motor for the insertion of worm-wheel holder 357. With the geared motor installed in the operative position the worm-wheel holder 357 is kept in the pocket 355 by the mounting surface of, for example, the motor-vehicle seat. The worm-wheel holder 357 is divided transversely to the axis of rotation of the worm wheel 325 seated on a driven shaft 327. Its two halves, designated 359 and 361 in Figure 6, enclose between them the worm wheel 325 which is thus fixed axially. The halves 359, 361 are applied positively one aginst the other along overlapping edges 363. Two surfaces 365, 367 facing towards one another in the direction of the driven shaft 327 secure the worm-wheel holder 357 in axial direction of the driven shaft 327. The driven shaft 327 is mounted on either side of the worm wheel 325 in bearing shoulders 345, 347 which emerge from the pocket 355 through openings 369 (Fig. 7). The gear casing 311 may be made of plastics or metal; the worm-wheel holder 357 together with the bearing shoulder 345, 347 formed on its two halves 359, 361 consist of plastics. The worm wheel 325 may be forced on to a peripheral knurling 343 of the driven shaft 327, as shown in Figure 6; however, it may also be joined in one piece with the driven shaft 327.

During assembly of the geared motor according to Figure 6, before or after the fitting of the electric motor to the gear casing 311, the two halves 359, 361 or the worm-wheel holder 357 are placed on to the driven shaft 327 already joined to the worm wheel 325 and the worm-wheel holder 357 thus assembled is pushed into the pocket 355 of the gear casing 311. If required during conveyance, the worm-wheel holder 357 can be fixed to the gear casing 311.

If the worm wheel 325 and the driven shaft 327 are

designed as an integral moulded plastics part, it is possible for a metal reinforcing insert to be moulded into the driven shaft 327.

CLAIMS

1. A geared motor comprising an electric motor and a worm gearing combined with the electric motor to from a unit, the worm of said gearing being mounted in a gear casing on a main shaft of the electric motor, which main shaft extends into the gear casing and is mounted thereon, and the worm wheel of said gearing being securely fitted on a driven shaft likewise mounted in the gear casing, the driven shaft being mounted in the gear casing on axially opposite sides of the worm wheel, said worm wheel being seated both axially fixed and incapable of independent rotation thereon, and being retained axially by two casing surfaces holding the worm wheel between them.

2. A geared motor as claimed in Claim 1, wherein the part of the gear casing holding the electric motor and the driven shaft is a one-piece moulded part, the driven shaft in the region of the worm wheel carrying a peripheral fluting or peripheral toothing which projects radially beyond the diameter of at least one of the two shaft portions extending as far as the associated axial end or ends, at least one of the two shaft portions being seated in an exteriorly open plain-bearing aperture whose internal diameter is equal to or larger than the external diameter of the peripheral fluting or peripheral toothing.

3. A geared motor as claimed in Claim 2, wherein the driven shaft is of different diameter on either side of the peripheral fluting, in which case the larger diameter is the same as the internal diameter of the open plain-bearing aperture.

4. A geared motor as claimed in Claim 2, wherein the driven shaft is of equal diameter on either side of the peripheral fluting or peripheral toothing, a space-compensating bush being inserted into the open plain-bearing aperture.

5. A geared motor as claimed in Claim 4, wherein the space-compensating bush carries at least one snap member engaging in the gear casing, which snap member secures the space-compensating bush axially and/or peripherally.

6. A geared motor as claimed in Claim 5, wherein the snap member is designed as a hook-like radially flexible tongue projecting axially from one side end of the space-compensating bush.

7. A geared motor as claimed in Claim 4, wherein the space-compensating bush has on its outwardly facing axial side end a radially outward projecting flange and is adhered to the gear casing.

8. A geared motor as claimed in Claim 4, wherein the space-compensating bush is made of plastics.

9. A geared motor as claimed in Claim 2, wherein on that side of the gear casing remote from the worm there is provided an insertion aperture for the worm wheel, which aperture can be closed by a cover and is directed towards the fastening surface of the geared motor.

10. A geared motor as claimed in Claim 1, wherein in a part of the gear casing holding the electric motor there is provided a pocket, open transversely to the axial direction of the worm, for a worm-wheel holder which can be inserted into the pocket, the worm-wheel holder can be inserted into the pocket, the worm-wheel holder being divided transversely to the driven shaft for the installation of the worm wheel of the worm-wheel holder.

11. A geared motor as claimed in Claim 10, wherein the pocket is open towards the fastening surface of the geared motor and the worm-wheel holder terminates at the fastening surface.

12. A geared motor claimed in Claim 10, wherein the pocket has mutually facing stop surfaces in the direction of the driven shaft, the divided worm-wheel holder being inserted between these stop surfaces.

13. A geared motor as claimed in Claim 2 or Claim 10, wherein the gear casing consists of plastics at least in the zone of the bearings for the driven shaft of the worm wheel.

14. A geared motor as claimed in Claim 1, wherein the driven shaft has an axial orifice of polygonal internal section at least at one of its axial side ends.

15. A geared motor substantially as hereinbefore described with reference to and as shown in Figures 1 and 2, or in Figures 3 and 4, or in Figure 5 or in Figures 6 and 7 of the accompanying drawings.

16. An adjustable motor-vehicle seat comprising a geared motor as claimed in any preceding claims.

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